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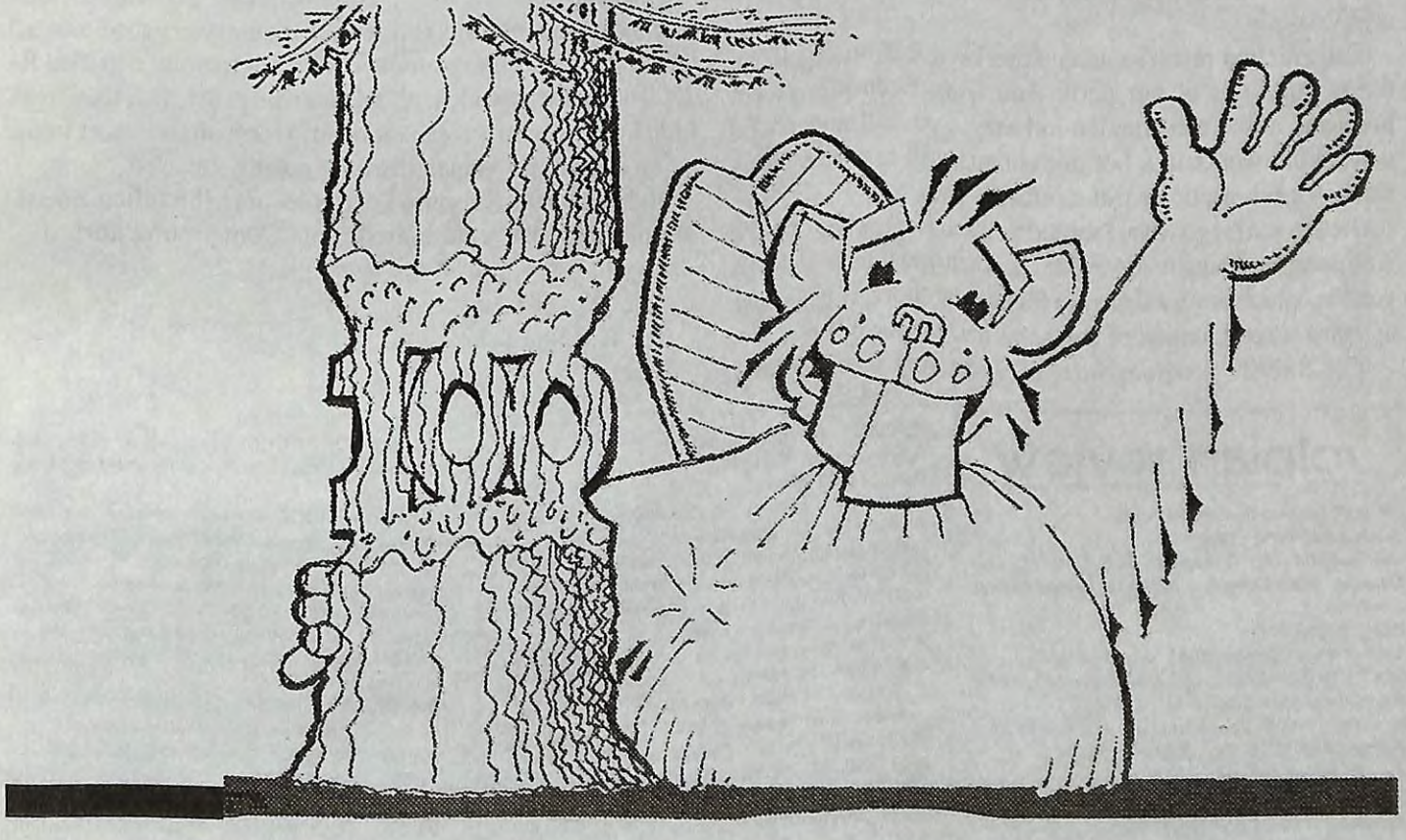

From the Editor . . .

It's hard to believe that this is the 100th issue of Solplan Review. To do a retrospective piece would be cheap a journalistic ploy. However, in this age of electronic communication and instant gratification it is especially important to keep a broader perspective on what we are doing. It is good to look back from time to time to see where we've been-and where we are headed.

Sixteen years may seem like a long time, but it is less than the term of a mortgage. As I look back on the 16 years Solplan Review has been published, I see how we forget, or fail to pass on, lessons learned. Perhaps it is a human condition - but we have a hard time learning from past mistakes, especially in this industry. We seem to repeat them.

We are too often bedazzled by the products of new technology. The technology itself becomes the product and not the tool to deliver something with inherent value. Manufacturers dream up new products. Usually, but not always, these products are meant to deal with a specific problem. Once the products are developed and in use, the sales people take over and try to convince everyone, regardless of location, that the new product or technology simply must be used. Yet, unlike most consumer and household goods, for many construction products and techniques "one size fits all" does not always apply.

Construction must be adapted to local conditions. If we forget this, it is at our peril. And if you consider recent problems in the construction industry, you will understand why. What works in a hot dry climate will not necessarily work in a sub-arctic or wet rainforest one.

Sixteen years ago when I started Solplan Review, no one else was doing anything comparable. It is marginal as a business venture, which is why there are few competitors. It has ended up being a combination of bad habit and labour of love.

The R-2000 program was in its infancy when Solplan Review started. One of the program's cornerstones was builder training - in an industry where traditionally there was little formal training at all. Knowledge was passed down from generation to generation, from father to son, through construction guilds, and on the job site. Skills were passed on, but so were errors and misunderstandings about building performance and why things were done the way they were.

Evolution and change were slow, as was the tempo of construction. If innovation were introduced, only a few buildings would incorporate it. If new, and the change turned out not to work, the consequences were not drastic. Today, construction is quick. If a problem develops, a large number of buildings end up suffering the consequences of inappropriately used technology.

Training was crucial to the R-2000 program, as it was in introducing energy efficient construction techniques to a sceptical audience. Getting out the message that a house is a whole system required a carefully studied approach to changing construction practices. The R-2000 program was breaking new ground and was backed by many years of research. We already had the ability to do it right, but the message had to be got across to the job site.

The early years of the R-2000 program generated much enthusiasm among the residential industry, even if not all builders who took the training continued to build certified R-2000 homes. But while enthusiasm was generated, there was little follow-up. In a weak moment, I took on the effort to fill a gap and offer a vehicle for this communication.

Judging by the response I get, it seems to be filling a need. Despite the occasional biased rants from your editor!

Richard Kadulski,
Editor

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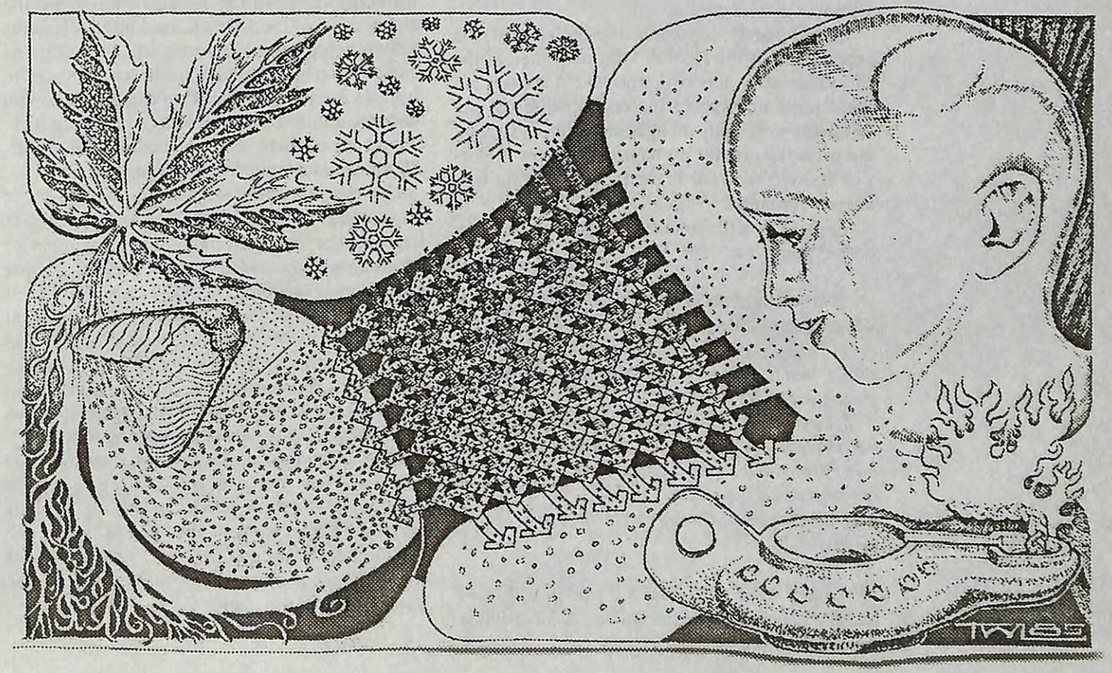
While preparing this issue of Solplan Review, I went back over the last 100 issues. A wide range of building science topics, especially ones focusing on energy efficient construction, has been discussed over the past 16 years.

One of the most consistent themes has been ventilation. We've known for a long time that proper air change is important to maintaining good indoor air quality. Ventilation standards have been in place in a number of countries for some years. In Canada, CSA F326, the Standard for Residential Mechanical Ventilation, has been in place since 1989. There has been more high quality equipment available on the market to satisfy ventilation needs.

But providing adequate ventilation in a home still presents challenges. It is interesting to note that, in the USA, there are fairly strict ventilation requirements in some states, while in others there are no standards at all, and the National Association of Home Builders (NAHB) is resisting setting any. Although ASHRAE has a mechanical ventilation standard for commercial and institutional buildings, it has been unable to set a standard for ventilation for houses due to lobbying pressure from certain sectors of the building industry. It seems that a portion of the home building industry is in denial about the need for proper ventilation.

From its inception, the R-2000 program has stressed the need for balanced air change. Yet the way to ensure that adequate ventilation is built into a home has remained a challenge. There is still a nagging suspicion among many builders about the need for mechanical ventilation. The constant challenge that builders face is how to comply with whichever standards are already in place.

I decided to reprint selections from a few early issues of Solplan Review that discussed the need for mechanical ventilation.



From Solplan Review No. 11, November 1986

Indoor Air: Is It Dangerous to Your Health?

The importance of good indoor air quality has been known for some time. It was already gaining prominence in 1986. This piece, first published in November 1986, could easily have been written this week.

A recent nationally syndicated medical column, which appears in major Canadian newspapers, discussed indoor air quality. The column, written by a doctor, underlines the ignorance that exists among the general population about the importance of a sound maintenance program for household mechanical equipment.

A leaky roof or tap is easy to see and fix, but improperly functioning equipment will not be recognized quickly. The problems are often invisible.

For the low energy builder, and the R-2000 Program, the challenge is to educate the public and overcome fears about tightly built houses. There are problems with new construction practices, but these have been, and are continuing to be, dealt with in a systematic fashion.

Unfortunately, copycat houses built outside the supervision of the R-2000 Program, often at the insistence of owners who want to cut corners but don't quite understand the consequences of not following a carefully thought out building system, are prime targets for problems. The most important R-2000 criterion is the requirement for balanced ventilation.

The author of the column (talking about his new house) points out that:

"The house didn't come with any instructions. All we were told was that the thermostat controlled everything. I discovered that the furnace had filters, and then discovered that the humidifier sat on the side of the furnace.

I removed the lid to find a . . . sponge made so hard by mineral deposits that it would have cracked had I dropped it . . . The water . . . was yellow and covered with a slimy, greasy sludge. What had this marvel of technology been discharging into the air we breathed . . . ?"

He goes on to talk about legionnaires' disease and other respiratory diseases identified with faulty air-conditioning systems.

The implications are clear. Faulty or poorly maintained ventilation systems can create significant health problems, and there is considerable documented evidence to prove it.

Recently, a series of television stories have dealt with indoor air quality problems, mainly in office and commercial buildings - the so-called 'sick building' syndrome. Usually these are directly related to completely sealed buildings that rely on central heating/ventilating (HVAC) plants, where design or maintenance faults can lead to conditions that make it difficult to maintain good air quality.

The use of these central HVAC systems is relatively recent. It is only since the 1950s that there has been widespread reliance on mechanical systems to provide conditioned and liveable conditions inside buildings.

A major feature of the modern commercial building with a central HVAC is that the building is completely sealed - windows don't open, so the only source of air is through the central system. If there is a problem with the HVAC system, all occupants of the building will suffer.

Energy conservation activity spurred by the energy crisis of the 1970s has meant that systems now are being built to perform to the limit. Energy conservation has become a major design criterion. Systems are being designed to recycle maximum amounts of air, draw minimum amounts of fresh air and rely on filters and scrubbers to clean the air. All are new techniques and approaches.

However, these HVAC systems, like the choke on your car, can be throttled down too far. If this happens, the quality of the indoor air will not be adequate and can lead to the various problems that are only now beginning to be recognized.

In recent years, people have begun to sense that something is wrong with the existing central systems in their work environments. This is why they become very concerned about talk of airtight houses.

As any low energy builder will appreciate, even the tightest house does not present the same situation as a commercial environment because the house still has windows that open - and in each room at that! So the resident can easily control his or her own environment. If it gets too stuffy, the window can be opened. As well, a properly built "tight" house will contain a ventilation system of some sort. Unfortunately, too few in the general public understand that. Ventilation systems for houses are too new an idea for most people.

In recent years, most conventional houses have been tightened up, so much so that the newly revised National Building Code has recognized the need for some form of mechanical ventilation. Up to now, balanced systems in traditional housing gave been the exception rather than the norm. Continued R-2000 Program monitoring has proven that indoor air quality in a well built and designed house will be better than in a conventional house.

R-2000 builders are already familiar with (and hopefully thoroughly committed to) the need for balanced ventilation. For the new code changes to be successful, a considerable amount of builder and public education is still needed.

One interesting development we have heard about is a proposal by the Greater Victoria Homebuilders Association to make attending an R-2000 builder's workshop a condition of membership.

The Homeowner's Part

You can have the best-designed ventilation system, but if it is not maintained properly, it will not do any good. As the doctor pointed out in his column, some parts of the system might provide the ideal conditions for breeding bacteria strong and nasty enough that breathing in the house could be hazardous to the health of the resident.

We know that many people are not familiar with or keen enough to maintain their house properly. Those of us in the building community may find this hard to understand. After all, it is not that hard to change a filter in the furnace, is it? But then, because that is our livelihood, it is second nature to us. It seems so simple to tell a new homeowner to "be sure the filters are changed two or three times a year, and etc . . . " But you have to remember to do it!

But the homeowner, who may be a doctor, banker, salesperson, teacher, stockbroker, or whatever is often much more interested in other things. To him or her, an ordinary furnace or hot water tank is a technological marvel with strange knobs, screws, and pipes whose meaning and purpose are totally unknown (and they may be afraid of breaking the whole thing if they touch something the wrong way).

To do any regular maintenance, a homeowner has to remember that the equipment is there. If it is located in some dim part of the basement or crawl space, it will be forgotten (or not even discovered!) until something goes wrong.

(Personally, that is the way I deal with my car - I know where to put the gas and how to turn the key, but if something goes wrong, it's panicsville! Just what is all that stuff under the hood?)

Why place so much stress on ventilation systems and their upkeep?

We know that natural air leakage into houses has been reduced by changed and improved construction techniques. Apart from issues of increased concentrations of pollutants in the house, there is a greater risk of carbon monoxide poisoning or asphyxiation to its occupants if combustion appliances do not have adequate provisions for combustion air.

A 1982 report estimated that 10 people die in Canada each year and another 100 are hospitalized because of carbon monoxide poisoning due to incomplete combustion.

Balanced ventilation systems for occupancy are not meant to provide combustion air, but if there were an inadequate supply of it, the ventilation system would tend to reduce buildup of toxic gases and ensure that the indoor air was constantly flushed clean.

So what is the solution to a healthy, sound design? There are a few points the builder should keep in mind.

Above all, the system design should follow the KISS principle: keep it simple stupid.

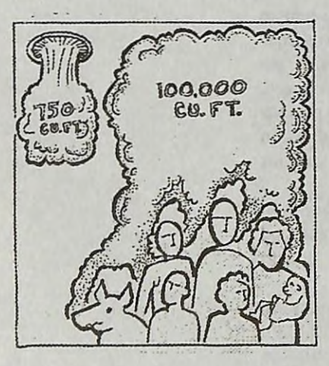
Secondly, Murphy's law should be accepted as a given. If something can go wrong, it will. A simple design, with a minimum of complex parts that can break down should be used. Always assume the worst possible scenario.

Thirdly, when selecting equipment, look for the best, most durable, and most easily serviceable equipment. If it is worthwhile to use a complex piece of equipment, look for its track record, warranty provisions, and availability of service and parts. (Why use a piece of equipment that can only be maintained by factory trained service personnel in a location where such personnel are not available and, if parts are needed, it will take two weeks to airlift them?)

If the equipment has filters that require periodic maintenance (and ideally that would be several times per year) do not place the equipment in a spot that only a four-foot tall Olympic gymnast can easily get at. Some HRVs have filters inside the main unit which should be cleaned several times a year, yet we have seen units in very shallow crawl spaces, hard-to-get-at attic spaces, or hanging high in a workshop. Any guesses how often those filters will be changed? We will not even think about the second purchaser.

Finally, a simple user's manual should be provided - something simple - even a one page typewritten list of points to check and maintenance to perform. This could be attached next to the electrical panel (which sooner or later everyone finds). ☼

Ventilation: How Much Is Really Needed?



From Solplan Review No. 21, July 1988

For some time now there has been considerable debate over how much ventilation is needed.

Internationally, a consensus is emerging that a continuous flow of 15 cfm per person per day (for non-smokers) is needed. This is 21,600 cubic feet per day per person.

A 50-cfm bathroom fan will likely, at best, provide 25 cfm (the rest being taken up by resistance of ducts, backdraft dampers and insect screens). A bathroom fan may be on for only an average of 30 minutes per day, thus moving only about 750 cubic feet of air per day.

Detailed monitoring was done on a new R-2000 home in Vancouver. The home, a five bedroom, 1900 sq. ft., two-storey house with a partial walk out basement, is occupied by a seven-person family (two adults and five children aged one to eight). The monitoring results show that, on an average winter day, the total ventilation measured was 100,000 cubic feet. Indoor conditions maintained 50% relative humidity, CO_2 concentration peaked at 1000 ppm, and there were acceptable odour conditions. The ventilation rate is equivalent to 0.19 ACH. ☼

Measuring the Performance of Energy Efficient Clothes Washers

Energy efficient front-loading clothes washers do have measurable benefits. A recent study sponsored by the US Department of Energy (DOE) looked at energy and water use in 50 apartments in a suburb of Boston. Energy and water use was measured before and after installation of Maytag Energy Star Neptune washers and dryers. The results showed significant water and energy savings over a five-month test period.

On average, the washers used 50% less energy, 41% less water and 19% less detergent than conventional washers. Dryer energy consumption fell by 22% because the washers' higher spin speed reduced the water content in the washed clothes. The DOE estimates that the new washers will save the building's residents 211,000 US gallons of water annually, resulting in savings of $2,380 based on current water rates.

This may seem like modest savings to individual dwellings. However, it was calculated that if every Boston household used these machines, residents could cut their energy bill by nearly $11 million per year and save enough power to run 14,000 homes. In addition, Boston would save more than 1.5 billion gallons of water annually.

This was not a unique study. It expands and validates a similar study conducted in rural Kansas in 1997.

This study underlines the importance of looking at the performance of all household appliances. Builders who offer appliance packages with new homes should use the most efficient units on the market. There are several front-loading washing machines currently available. ☼

Water Protection and Exterior Basement Insulation

Exterior insulation on basements not only creates a warm interior space, but also can solve basement moisture problems.

Basements are increasingly used as living space. Yet the way most builders build basements has not changed from the days they were nothing more than foundations and cold cellars.

Basements insulated on the exterior not only create a warm interior space, but also solve many basement moisture problems. Exterior basement insulation provides thermal resistance between the soil and the interior, keeping the foundation wall warmer, and protects the structure from moisture in wet soils, and from heaving and adhering soils due to frost action. Exterior basement insulation also provides a means of water management at the surface between the soil and the insulation and helps the structure to dry out.

Rigid foam and rigid fibreglass insulation are the most commonly used exterior basement insulation. It is also possible to use spray-in-place foam insulation applied to the outside of the basement walls.

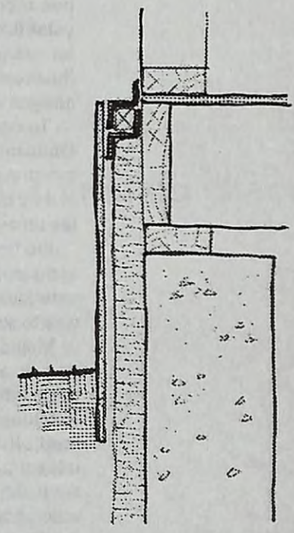
Spray-in-place foam insulation on the exterior of basement walls may seem an unusual application of the product but it can be used successfully for moisture management of foundations. The Canadian Urethane Foam Contractors Association and the Institute for Research in Construction did a two-year research project to test the performance of exterior basement insulation products in contact with the ground.

The weather during the test period went to several extremes, including record rains and winter thaws. To create a worst-case situation, the soil at grade was sloped 5% toward the wall to simulate a settled condition.

As expected, water was observed at the outer surface of the foam insulation during the periods of heavy rain and major thaws throughout the two-year period. Over the same period, the outside face of the concrete (inside the insulation) showed no evidence of water penetration through the insulation layer.

After 31 months of exposure in the soil, samples of the foam insulation were analyzed. Its performance did not change, and the measured values of water permeability matched published values. The insulation was not affected by water movement over the exterior face.

However, the foam must be protected at grade and above. Once the insulation was in place, cementitious boards were fastened to z-bars and a wood spacer. No other fasteners were used, so the cementitious board was effectively "cantilevered" over the insulation specimens.



Damp-proofing, which is not water-proofing as many think, should not be needed with a spray-in-place foam insulation strategy. Damp-proofing is applied to create a capillary break in the concrete surface, but with a spray foam insulation it is the insulation that provides the moisture protection as well.

The tests confirmed the moisture management capabilities of unprotected spray polyurethane foam insulation. The thermal performance does not change and the material does not absorb water. ☼

In-situ Performance Evaluation of Exterior Insulation Basement System Polyurethane Foam Summary Report, National Research Council.

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Why We Should Care About Mouldy Houses?

There has been much coverage recently about mould because of the link between mould in a home and the health of its occupants. Studies have shown that this link exists even after taking into account the effects of smoking, the level of volatile organic compounds, CO2 in the indoor air, or possibly-related biologically household dust contamination including dust mite and pet antigen levels.

To ensure a healthy indoor environment, contaminants must be eliminated at the source. We can prevent the construction of problem houses, and we can also make strong recommendations for the renovation of houses with existing problems.

Studies have shown that there can be large variations between houses and even within an individual house, when considering levels of exposure to some types of bio-active materials.

Moulds generally require four conditions for growth: a suitable surface to grow on, appropriate temperature, food and moisture. The first three conditions are present in all environments in which people live. The only way mould can be controlled is to control the level of moisture. Condensation on the building envelope is one of many sources of water, enabling moulds to grow. This is why well-insulated building envelopes are desirable.

The presence of local moisture sources is a much more important factor in the level of biological contamination than the amount of general ventilation in the house. The number of people in the home will affect the humidity level, but so will the amount of air change.

Moisture problems and mould exposure do lead to some types of disease, and the rates are significant. The problems may be the result of envelope performance failures, occupant behaviour, or a combination of both. In homes with reported health problems, there may be a large range of bacterial endotoxins, dust mite antigens, cat allergens and mould mass. Tests on visible mould have shown an unusually large fraction of mycotoxin-producing moulds. If we could reduce the incidence of moisture and mould problems, we could improve the health of occupants significantly.

Why We Should Care about Mouldy Houses
report prepared for CMHC by Morrison Hershfield Consulting Engineers

What are the conditions in a house that could point to mould problems?

In CMHC's Wallaceburg studies, a higher proportion of problem houses did not have a forced warm is distribution system, and were heated with fuel sources other than natural gas. The lack of forced air distribution could be a factor in the growth of biologically active contaminants. This may be because, without an effective ventilation system, the forced warm air system circulates the air in the house. Whatever air change may be present (caused by natural air change and stack action) will at least be redistributed. Homes with wood burning equipment (wood stoves or wood burning fireplaces) had more problems than those without.

Visible evidence of water damage and areas of mould growth by itself may not be a good predictor of whether houses have high levels of biologically-active contaminants. Much more important is the relationship between the airtightness of the house, the air change, and the relative humidity.

Conventional logic would suggest that a tighter building, which has a lower air change, will result in higher relative humidity, higher levels of condensation and biologically active contamination. These were not the findings. Biological contamination problems were not strongly related to low levels of air change and resultant high levels of general humidity.

The "bad" houses, on average, had higher tested air leakage, higher air change rates and lower average humidities. The bad houses also had more smokers, waterbeds, humidifiers in the bedrooms and residents had a much lower income level.

The Wallaceburg studies showed that the relationship between house construction and operation, biological contamination levels, and health measurements is complex and very specific to an individual house.

Moisture sources are not just related to occupancy, and the control of moisture sources is not just a ventilation issue. A major moisture source was "wicking" of ground water through the concrete. Control of moisture is also important.

Local sources of moisture, rather than high general humidity levels, may be the dominant factor in visible mould growth. Interior mould growth is connected with condensation on the building envelope. The most commonly reported trouble area is mould associated with windows, because windows have the lowest insulation value.

Common locations of mould growth not related to envelope condensation include:

- bathroom surfaces
- leaking basement walls
- pools of stagnant water (such as slow drying refrigerator drain pans).
- moisture in areas with direct soil contact (such as crawl spaces, below grade basement walls, and floor slabs).

General ventilation, important as it may be for other reasons, cannot be relied on to control mould growth and biological contamination.

Control of moisture sources in the house, particularly in soil contact areas, may be an important requirement in avoiding mould growth and biological contamination. ☼

The ***Condominium Owner's Guide to Mould*** gives a simple to follow procedure a homeowner can use to assess mould problems and how to do a clean up small mould areas. This is one in CMHC's "About Your House" series of fact sheets. Available from your local CMHC office or *www.cmhc-schl.gc.ca*

New Self-Cleaning Glass

Pilkington North America has started manufacturing a glass that allows residential and commercial windows and skylights to clean themselves. Pilkington Activ™ self-cleaning glass uses the sun's ultra violet rays to gradually and continuously break down organic dirt through a photocatalytic effect. At the same time, it reduces the surface tension of water to cause it to sheet down the surface and wash away dirt to leave windows clean.

Pilkington Activ™ glass is the first and only glass manufactured with these self-cleaning properties. A microscopically thin film is applied to the surface of the glass while it is still in its molten state, so it becomes an integral part of the surface – rather than after the glass is produced.

The pyrolytic process, not unlike the hard coat low-e coatings used on glass today, ensures the coating will not peel off and the glass surface will not discolour. Activ™ glass is being marketed as a value-added product and comes with a 10-year guarantee. Because it is a pyrolytic glass, the glass can be tempered, laminated and cut just like any other glass sheet.

Windows with Activ™ glass are almost as clear as any other clear float glass, but reduce ultraviolet light transmission by approximately 20%. Otherwise they perform like any other clear float glass. To increase the energy efficiency, it is still necessary to add an inside pane of Low-E glass to the window.

What makes the glass self-cleaning?

The Photocatalytic effect. When the sun's ultraviolet rays reach the coating, it interacts chemically with dirt, soil and other organic compounds to gradually dissolve them and break their adherence to the surface of the glass. It will not work on paint, varnish or inorganic compounds. After initial installation, windows with Activ™ glass must be exposed to UV rays for several days to activate the photocatalytic properties of the glass. Once activated, the photocatalytic process will continue to work at night and even on cloudy days.

The hydrophilic effect of the Activ™ glass pyrolitic coating reduces the surface tension of water, causing it to sheet on the glass surface. This prevents the formation of separate droplets, ensuring that loose particles of organic dust and dirt can be washed away from the surface and leave the glass nearly spotless. In dry weather, a simple squirt of water from a garden hose should be enough to clean the windows.

Pilkington Activ™ glass offers four key benefits that the company's customers can sell to the end user:

It saves time by significantly reducing the need to clean residential and commercial windows. If there is a dry spell, windows can be simply sprayed with water. Dirt that has not been dissolved will be wiped away by the water's sheeting effect.

It saves money by eliminating the need to buy window cleaning detergents or the need to hire a service company to clean windows.

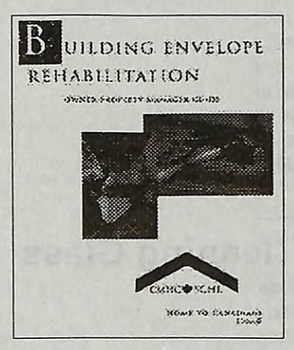
It eliminates the need to climb ladders and reduces the opportunity for accidents when cleaning upper floor windows or roof windows.

It eliminates the run-off of potentially harmful detergents into the environment because detergents are not needed.

Pilkington Activ™ glass will be available for widespread distribution throughout North America in late 2001. ☼

For more information about Pilkington Activ™ glass,call 1-866-882-2848, or go to *www.activglass.com or www.pilkington.com.*

Building Envelope Rehabilitation Guides



The building envelope failures in southwestern BC have received much coverage in the past few years. ***The Best Practice Guide: Wood Frame Envelopes in the Coastal Climate of British Columbia*** was prepared to provide design and construction guidance for new construction. However, many moisture troubled buildings must still be rehabilitated. That some moisture troubled buildings have been previously repaired and now require a second, more extensive rehabilitation effort underscores the need for guidance with respect to effective repair and rehabilitation measures.

Repair and rehabilitation is different from new construction. Assessing the damaged condition and rehabilitating a wood frame building takes many steps. Decisions must be made at each stage. Since the building is usually occupied during rehabilitation, the work is more complicated than for a new construction project.

A major problem has been the concern that everyone has about their liability. As a result, excess work is often being done. A consensus is only beginning to emerge about how much investigative and remedial work actually needs to be done.

Canada Mortgage and Housing with the Building Envelope Research Consortium (BERC) have published two building envelope rehabilitation guides for cost-effective rehabilitation of moisture troubled buildings. They reflect current best practice in design and construction, and deal with the differences between new and rehabilitation construction. The most common problems are illustrated with clear colour photographs.

The ***Building Envelope Rehabilitation Consultant Guide*** is mainly for professionals and focuses on the repair and rehabilitation of building envelopes of multi-unit wood frame buildings in the coastal climate zone of British Columbia. The ***Building Envelope Rehabilitation Owner/Property Manager Guide*** is a companion document for managers and Strata Councils. It focuses less on technical details and more on the process to help owners make informed decisions. It helps explain why buildings have failed and why different technology may be required for rehabilitation. A discussion on managing repairs, including legal issues and an overview of the technical process is included.

The Consultant's Guide for the first time establishes standards for consultants. It reflects current best practices while providing guidance on the structural and life safety issues involved in the rehabilitation of moisture troubled buildings.

Building science principles for rehabilitation, including building materials and technical specifications are reviewed. Focus throughout the guide is placed on the factors that influence design decisions and the cost analysis of alternatives.

Beginning with the evaluation stage, methods are established for assessing the condition of the building envelope. A detailed assessment will:

- describe the building's exterior and interior environmental conditions, and identify areas of high humidity or unusual indirect conditions.
- determine extent and severity of the damage or symptoms of moisture problems
- determine the causes of moisture related problems
- list each of the envelope failures and describe the mechanisms involved.
- determine appropriate conceptual rehabilitation work strategies
- outline approximate construction cost estimates and implementation plans

A section explains how administrative responsibilities change at the construction stage. The consultant's role expands from agent of the owner to include certain additional responsibilities under the construction contract.

This guide is a technically comprehensive and reliable handbook available for building envelope consultants. It is the first of its kind to establish a protocol for the industry to follow.

The Building Envelope Rehabilitation Consultants Guide is available for $129.00. Each includes a CD that contains a slide show which shows a typical balcony-wall and window rehabilitation detail. These slide shows clearly show the way construction layers are installed, to create a rain screen detail that will manage exterior moisture. ☼

Building Envelope Rehabilitation Consultant Guide and ***Building Envelope Rehabilitation Owner/Property Manager Guide*** *Available from CHMC, Tel 800-668-2642; outside Canada 613-748-2003.*

Www.cmhc-schl.gc.ca

Climate Change: What You Can Do About It

Everybody talks about climate change, but nobody does anything about it. Now they can.

It is urgent we prevent climate change from entering a runaway phase, which will lead to irreparable damage to the earth's ecosystems. This will happen when the ice fields melt, rainforests dry, and oceans warm. In the north, it means the thawing of permafrost , the disappearance of animal species and other unsettling ecosystem changes. The consequences are almost unthinkable. And we are already seeing the effects of change—not just in the far north—even in more southern latitudes.

The last three generations have benefited from the comforts created by industrial development. However, we are now discovering that it will be our children and grandchildren who will pay for such comforts - unless we start to take action today. But what can we do?

A new book, appropriately titled Stormy Weather, has been written to deal directly with the big issue facing our globe this century. It describes the basics of climate change, highlights the best solutions being implemented today around the world, and offers guidance for readers. The authors set out to consider what would have to be done to reduce global emissions by 80% by 2025.

For those working in the oil patch, this might seem a ridiculous target. Already the business press has been spreading tales of gloom and doom to come if even the most modest Kyoto objectives are implemented. Their rant ignores the fact that production of fossil fuels - gas and oil - have peaked, and are now declining. However, for those involved in creating the solutions (solar, wind and other renewable energies, energy efficiency, hydrogen, smart growth, hybrid electric vehicles, ethanol, car-free communities, organic farming, eco-foresty, and so on), it is an exciting challenge.

The 288-page book has been designed as a series of self-contained 2-page sections, each of which describes an issue, offers solutions based on the best practices, and includes a listing of web-based resources and other material. It is an easy read, and ought to be required reading for everyone who is concerned about our planet's climate.

The facts and figures, explanations and solutions, backed up by numerous Internet links, provide a comprehensive guide to climate change. Guidance is offered on climate change solutions the world needs to take. The book offers solutions for everyone - for homeowners wanting to reduce high bills, corporate executives seeking clean ways to improve profits, and for government leaders looking for practical action.

If global warming seems like an overwhelming challenge, Stormy Weather is your answer. It is both a handbook and a blueprint of practical ways to cool the climate. Global warming solutions are available. Implementing them will give us a cleaner, healthier, more prosperous world. ☼

The links listed in the book also appear on the book's site at www.earthfuture.com.

Stormy Weather: 101 Solutions to Global Climate Change *by Guy Dauncey with Patrick Mazza, New Society Publishers http://www.newsociety.com US$19.95 CAN $27.95*

Ways you can make a difference

1. Use only the most fuel efficient vehicles. Based on 15,000 miles travelled, a Toyota Prius will generate 4 tons of CO_2, a Suzuki Swift 5 tons, and a GMC Yukon 12.9 tons.
2. Chose the most energy efficient household appliances.
3. Build only the most energy efficient homes. The R-2000 standard should be the minimum.
4. Upgrade the energy efficiency of your current house and business premises.
5. Optimize construction to take advantage of solar energy. Passive solar gains for space heating; active systems for domestic hot water heating (or preheating). Where on-site electrical generation is being used (e.g., in rural or off grid areas) use a hybrid photovoltaic-generator system.
6. Where it is an option, buy green power.
7. Use recycled construction materials wherever possible.
8. Use locally produced construction materials instead of imports.
9. Encourage planning of more compact, pedestrian friendly communities.
10. Support sustainable farming and forestry: buy local, sustainably produced products.
11. Encourage modest, well designed, compact home designs. If there is an option, encourage renovation and redevelopment of existing structures instead of demolition.

From Solplan Review No. 7, March 1996

Getting Full Value From Insulation Installation

To be effective, insulation must be installed correctly. Studies have shown that even small imperfections in how insulation is installed will significantly reduce its performance.

The problems associated with the settlement of loose fill insulation are obvious. However, batt insulation can also sag and create voids - especially if they are not the full depth of the wall, or if they are narrower than the framing space into which they are put.

Unfortunately, insulation installers usually work on a piecework basis, so have every incentive to cut corners - especially if they can get away with it! The most important feature of a good insulation job is that the insulation is fitted snugly and uniformly with consistent, even coverage, avoiding any gaps that could provide spaces for convection currents to develop.

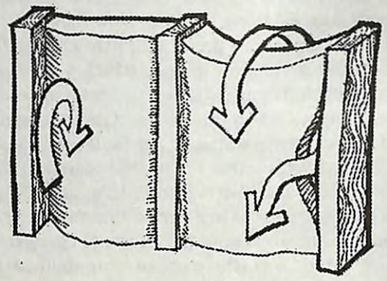
Blown loose fill insulation

The best way to be certain that loose fill insulation will reasonably match the desired R-value is by ensuring that the installer uses the number of bags of insulation specified by the manufacturer.

It is not unknown for installers to fluff up the material more than required, or to apply the insulation using less material than designated by the manufacture for a given R value. The lower density will not provide the thermal resistance, not to mention the fact that it will settle more over time. The installer leaves the owner with the impression he's done a good job ("Look, I've put 12 inches of insulation, just what you ordered.") but he's used three fewer bags of insulation (for which he's charging).

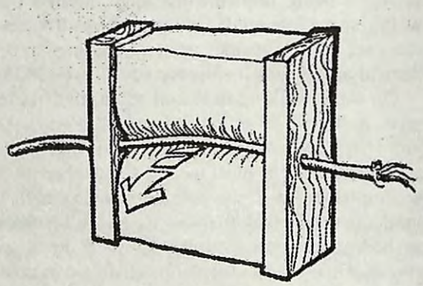
Batt Insulation

Batt insulation is the most common insulation material used in walls and, when improperly installed, can reduce thermal resistance. This usually happens when batts are stuffed against framing, blocking and services in a wall. Installers will not always adequately cut through the insulation around electrical wiring so as to cover it tightly.



Batts are made just slightly wider than framing, so the installer must force the batts into the cavity. The edges of the batts are bunched, and the voids created provide a nice channel in which vertical convection currents can develop to siphon heat out.

The important issue for the user is to anticipate and plan around the shortcomings of the material. It is always easier to solve problems before they occur! ☼



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Vancouver House Renovation to be an R-2000 Retrofit

The R-2000 program is a new home program with a focus on energy efficiency, indoor air quality and environmental responsibility. However, most of the housing for the next half-century has already been built. The challenge is therefore not only to build new construction to the highest energy efficiency standards, but also to improve the existing housing stock.

The Energuide for Houses program is designed for existing houses. It provides owners with a rating of their home and offers suggestions for cost-effective upgrades; taking into account that there is always an opportunity to make changes whenever maintenance and renovation work are done on a house. Just how far the upgrades go, will depend on the nature of the renovation work.

A house in East Vancouver will be an example of such an upgrade. The scope of the work offers an opportunity for the fully renovated house to meet current R-2000 standards. When the renovation is completed, the house will be certified as an R-2000 house. Renovation is a departure for a new home program, but there has been discussion about certifying major retrofits. To date, this has not been done.

The house is a typical East Vancouver bungalow built in 1957, with a basement four feet into the ground. Its design is typical of many houses built throughout Western Canada at that time.

This renovation is driven by the need to incorporate indoor air quality improvements, energy efficiency upgrades, and a modest amount of flex-housing principles for the future. The work is being done because the homeowner has major health and respiratory problems, the result of work-related exposure to chemicals.

Typical of many houses in the area, it has an open storm water sump in the basement that is a source of soil gases and excessive moisture. As was common at the time, the house was poorly insulated. The exterior walls are 2x4 with R8 insulation. Thermal bridging through the framing is evident, as is mould growth. No doubt, this was made worse because of the higher moisture content in the basement.

The house is being stripped to the framing, and a half storey is being added. The structure will be upgraded as will the exterior envelope. The exterior walls will be 2x4 with R12 batt insulation with 1 ½" rigid Styrofoam sheathing on the exterior. The detailing will include air sealing the structure to meet the R-2000 air tightness standard.

The original single glazed aluminum frame windows will be replaced with new double glazed high performance windows.

The HOT 2000 analysis shows that with the work proposed, the energy consumption for space heating and domestic hot water will be 12,904 kWh/yr, compared to the R-2000 target of 17,003 kWh/yr for this house.

The original furnace was replaced a few years ago by a high efficiency sealed combustion furnace, and the hot water tank by an electric hot water tank. Since these appliances do not require open flues for venting, the air change through the house was reduced, contributing to poor indoor air quality.

The new mechanical system will rely on a high efficiency, natural gas fired, condensing hot water heater for domestic hot water and forced warm air heat. A heat recovery ventilator will also be installed to ensure a continuous air change inside the house.

The open sump in basement, a major source of moisture and sewer gases, will be moved outside the house.

When the work is done, this 40-year-old house will be like new and good for many years to come. It will be certified as an R-2000 home. A first for the program. ☼

R-2000

For information on the R-2000 Program, contact your local program office, or call 1-800-387-2000

Technical Research Committee News

Canadian Home Builders Association

House Commissioning

Work is underway to develop a procedure for house commissioning. Commissioning may be a new buzz word in this industry, but in essence it is no more than what car dealers do when they "dealer-prep" a vehicle before it's sold—checking to make sure that all systems are working properly.

More and more commercial and institutional buildings are being commissioned by professionals charged specifically with this task. This has come about because it's been found that the performance of many buildings can be significantly improved by proper commissioning, without need for expensive retrofits.

Similar improvements in building performance can be expected in the residential sector. Although we might think that we commission and inspect a home carefully before turning it over to a homeowner, in practice many details are missed. Too often the focus may be on surface details - the paint job, drywall cracks and other cosmetic details, rather than on the home's more substantial operating systems. A protocol for house commissioning will provide a helpful checklist of steps to be taken to ensure all systems are checked.

User Guide to the Plumbing Code of Canada

The Institute for Research in Construction has just published the latest in its series of user guides to codes. This one reviews the plumbing code, and sets out the intent behind all code requirements. Understanding the intent helps users evaluate the application of new products and alternative techniques.

The Technical Research Committee (TRC) is the industry's forum for the exchange of information on research and development in the housing sector.

Canadian Home Builders' Association, Suite 500, 150 Laurier Ave. West, Ottawa, Ont. K1P 5J4
Tel: (613) 230-3060
Fax: (613) 232-8214
e-mail: chba@chba.ca

Energuide for Houses to Continue

This home energy rating program has now audited more than 27,000 houses across Canada. Follow up studies have shown that about 25% of those homeowners have taken some action based on the recommendations provided by the Energuide evaluation. Natural Resources Canada has extended the program for another five years.

The Energuide program offers renovators a marketing opportunity. The blower door test, a part of the audit procedure, is a very visible way to show where the house envelope can be upgraded. The independent audit, done before work starts, shows the homeowner the opportunities for upgrades and calculates their payback.

Energy Star Products to Be Available in Canada

Labelling products for their energy performance is one of the most effective ways of changing consumer patterns without the heavy hand of regulation. In Canada, we have the ***Energuide*** rating system. The USA has the ***Energy Star*** program.

The Energy Star program sets minimum performance criteria for products that carry its label. It makes it easy for consumers to make a decision when choosing energy efficient equipment.

Natural Resources Canada has entered into an agreement with the US EPA to import and administer Energy Star product ratings in Canada. This will be in addition to the Canadian Energuide program.

Since there is so much cross-border movement of goods, it makes sense for there to be uniform criteria for energy efficiency in the United States and Canada. This agreement should increase global supply and demand for energy efficient equipment.

In 2000, it has been estimated that the Energy Star program has resulted in greenhouse gas reductions equivalent to taking ten million cars off the road in the United States alone.

BEST Practice: Building Envelope Solutions Theory and Practice Course

Previously called the Builders Tool Box, is a course developed by CHBA-BC with CMHC and the Home Owners Protection Office. It is meant to give participants a background in building science that will allow them to understand how durable building envelopes are built. It will provide practical knowledge and skills to build durable wood frame building envelopes, and to restore failed wood frame structures.

This seven unit course, can be taken to suit one's schedule. The 42-hour course will be delivered in BC by the BC Institute of Technology in Vancouver, and by its affiliated agencies in other parts of the province based on need. This course has been recognized by the BC Industry Training & Apprenticeship Commission, which will provide 50% tuition funding for eligible trades persons.

Contents include: Introduction to Building Science; condensation control in wall assemblies; rain penetration control for wall assemblies, including materials and techniques; windows, doors, roofs, decks & walkways; new construction and restoration to resist rain water penetration; regulatory requirements & standards.

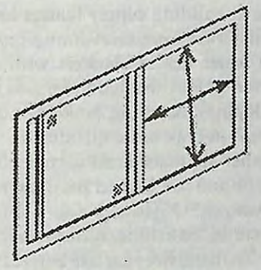
For information, contact Wayne Stevens, 604-453-4060 or *wayne_stevens@bcit.ca*

Saskatchewan Building Code Update: Ruling on Window Egress

In Saskatchewan, awning windows are no longer acceptable to meet egress requirements.

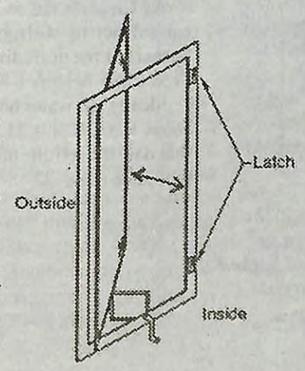
Windows not only to provide views and light, but can also be a means of egress from a room. A recently issued Saskatchewan Building Standards Advisory bulletin deals with egress requirements.

Articles 9.7.1.3. and 9.7.1.4. of the National Building Code require that unless a bedroom has a door directly to the exterior or is sprinklered, each bedroom must have at least one outside window that is operable from the inside. This window must provide an unobstructed opening with a minimum area of 0.35 m2 (3.77 ft2), with no dimension less than 380 mm (15 inches).



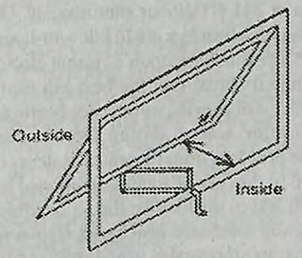
The unobstructed opening must be measured between the window components (sash, jamb, sill, opening mechanism, etc.) with the window in the fully open position. It is not simply the dimensions of the rough opening or the glass area. When a window required by 9.7.1.3. opens into a window-well, the clearance must be at least 550 mm (21.7 inches). If the sash swings toward the window-well, the sash operation must not reduce the clearance to restrict escape in an emergency situation.

The code intent is to provide occupants with a means of escape in an emergency situation. Although bedroom windows are not considered ordinary escape routes, using them in an emergency has saved many occupants.



Casement windows open on their vertical axis and usually have opening hardware installed at the bottom of the window. This hardware can obstruct an occupant's escape, so the opening should be measured to the hardware.

Full vent inswing awning windows have hinges at the top of the frame or at an intermediate mullion. This type of window latch does not use an opening operator and is able to swing open without restriction or be held partially open with intermediate catches. It swings in toward the user so it does not restrict the clearance if it opens into a window-well and the size of the opening is not restricted by the opening mechanism. This type of window is usually marketed as a "basement" window, and can satisfy the requirements of 9.7.1.3.



Insect screens, security bars, grilles or similar devices should be easily removable or releasable from the inside without the use of a key, tool, or special knowledge.

Awning windows in bedrooms are a concern when applying 9.7.1.3. Awning windows swing on their horizontal axis at the top of the frame or at an intermediate mullion. Only very large awning windows will provide an opening big enough at the side of the hardware that will meet code requirements. In general, awning windows do not meet the intent for a means of escape and do not comply with 9.7.1.3.

In Saskatchewan, awning windows are no longer acceptable to meet egress requirements. The change will have a short phase-in period for work in progress, but the deadline for change over is October 1, 2001.

A basement in-swing awning window is acceptable as an egress opening providing it offers open locking positions. ☼

The full bulletin is available on the Saskatchewan Municipal Affairs web site: *www.municipal.gov.sk.ca/safety*

Energy Answers

Rob Dumont

How do you put an insulation blanket on a water heater?

When I was a student, I once visited friends in Ottawa. They lived in a one bedroom apartment above a small grocery store on Bank Street. It had no air conditioning and very small windows. My visit was during the heat of summer.

A bare electric water heater tank sat in the living room without a fibre of insulation on it. The water heater was hot to touch, and the heat in that room that night was so stifling that 27 years later I still remember the experience. Insulation is important!

Most standard water heaters in Canada have only about 1 inch of glass fibre insulation. The heat loss through the jacket is substantial. I measured the heat loss from a standard 33 gallon electric water heater in our house, and it amounted to about 100 watts or 341 BTU/hour continuously. On an annual basis this heat loss is 876 kilowatt-hours, or about $75 a year at Saskatoon's current electricity price. While it is true that the heat lost from the water heater will provide some space heating during the heating season, during the non-heating season the heat loss from the water heater is of no value, and in the case of an air-conditioned building, it will add to the load on the air conditioner.

Ideally you want zero heat losses from a water heater tank; in practise this would require either a zero volume tank or an infinite amount of insulation on the tank. The former is not usually done, as hot water draws in conventional Canadian dwellings need a storage tank. Lots of insulation, however, can readily be added to storage tanks.

Figure 1. Adding a small amount of insulation to a water heater

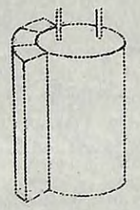


Figure 2. Step 1. Adding R20 (RSI 3.5) glass fibre batts to the exterior of an electric water heater.

Figure 3. Step 2. The batts should then be covered with foil backed insulation to give a neater appearance.

Figure 1 shows a diagram of how one might add a small amount of insulation to a water heater. *A very important detail with water heater blankets on gas fired water heaters is to ensure that the combustion air supply at the base of the water heater is not obstructed.* I have heard of a case where the water heater blanket slipped down on a unit, blocking the combustion air supply. The burners were starved for air, carbon monoxide was produced, and a homeowner was killed. DO NOT OBSTRUCT THE AIR FLOW TO FUEL FIRED WATER HEATERS! The draft diverter at the top of the water heater must also not be obstructed.

Occasionally I have seen water heater blankets for sale at building supply houses locally. A US company–*www.amconservationgroup*-- sells residential water heater blankets with either R 6.9 insulation or R11 insulation for less than $15 US each (shipping, handling, brokerage, customs duty, etc. extra) in bulk order quantities.

Another approach is do-it-yourself using glass fibre batts and foil backed insulation. That's how I did-it-myself. Figures 2 and 3 show how R20 batts were added to the exterior of an electric water heater. The batts were cut like barrel staves, placed vertically against the walls of the heater, and then covered with aluminum foil backed insulation. To properly secure the batts, I would recommend using narrow diameter wire around the perimeter of the insulation batts to securely attach the insulation. Duct tape does not have long term holding power. The top part of the water heater can then be insulated. Make sure to leave the pressure relief valve accessible for periodic testing.

It is also a good idea to add pipe insulation to the hot and cold water pipes for the first meter of pipes leading away from the tank.

As I mentioned earlier, you must be very careful not to obstruct the air flows to the burners or the draft diverter on the top of fuel fired water heaters when adding insulation.

Ideally, all water heaters would come with about R20 (RSI 3.5) tank insulation. Until that day, the retrofit measures I have outlined will have to do. ☼

NRC·CNRC

National Building Code Advisory Publications: Making Part 9 Work for You

by Robert Bullis

Just as not all buildings are alike, neither are the building codes pertaining to them, and sifting through the National Building Code (NBC) for the right information can sometimes be challenging. But for the designers, builders and building officials who use the NBC's Part 9 (Housing and Small Buildings that are three storeys or less in height and 600 square metres or less in area), there is an easier way to navigate the requirements.

Creating Solutions

When the first editions of the NBC were published, the writers assumed that users were trained in many aspects of building science and engineering. For architects and engineers, this worked well. But for those who wanted to build simple buildings that didn't require a high degree of architectural or engineering input, some aids were seen as necessary. In due course, the National Research Council, through its code committee structure, joined with the Central Mortgage and Housing Corporation (now the Canada Mortgage and Housing Corporation – CMHC) to produce what they called Part 9 – essentially a "mini-code" intended for use by contractors who build houses and small buildings, but who don't necessarily need to hire an architect or engineer.

The creation of Part 9 was an important and widely accepted development. However, code users requested more improvements to make code use even easier. In response, a series of three advisory documents were developed to both clarify and simplify Part 9: the National Housing Code of Canada 1998 and Illustrated Guide; the User's Guide – NBC 1995 Housing and Small Buildings (Part 9); and the User's Guide – NBC 1995, Application of Part 9 to Existing Buildings.

National Housing Code Of Canada 1998 And Illustrated Guide

The National Housing Code of Canada and Illustrated Guide extracts the elements of Part 9 that relate only to detached, semi-detached, and row houses that do not share egress or service spaces, and do not have one dwelling unit above another. Intended to assist those involved in building houses, including contractors, tradespeople, and inspectors, the first part of the publication lists the requirements, and the second part (following the same order as the first) provides advice on how to meet those requirements. As well, illustrations appear throughout the document.

User's Guide – NBC 1995 Housing and Small Buildings (Part 9)

Of special interest to designers and building officials, this User's Guide to Part 9 addresses requirements for all buildings covered under Part 9: buildings three storeys high or less; a building area not more than 600 square metres; and containing only residences, business and personal services, commercial, or medium- to low-hazard industrial occupants.

This guide is also well illustrated, but focuses more on understanding the principles behind code requirements.

User's Guide – NBC 1995, Application of Part 9 to Existing Buildings

The third publication looks at the challenges of applying Part 9 to the wide variety of conditions encountered during renovations of houses and small buildings. Of great value to renovators, inspectors and building officials, this guide is particularly useful when read in conjunction with the other Part 9 guides.

The first chapter discusses the principles that need to be followed in the regulation of existing buildings. This concentration on principles, rather than the actual "letter of the law" where requirements are concerned, allows users to focus on the primary objective of the NBC: protecting lives.

Chapter two of the guide presents 50 typical scenarios that code users might face during building renovations, or when the occupancy of a building changes. An appendix supports the first chapter with a collection of the intentions behind the nearly 1,000 requirements that make up the whole of Part 9.

Comprehensive Coverage

The three advisory documents provide users with a comprehensive coverage of the scope and application of Part 9. Apart, each has an entirely different focus and application, and each responds to specific user needs, whether homebuilder, contractor, designer or building official. Choosing the right one will depend on the job at hand. ☼

For further information regarding the Part 9 advisory publications, contact John Archer at 613-993-5569, fax 613-952-4040, email john.archer@nrc.ca.

To order any of the publications, call Publication Sales at NRC's Institute for Research in Construction at 1-800-672-7990 (in the Ottawa-Gatineau area or the U.S., call 1-613-993-2463).

Leaky Condo Legal Update

The first significant legal decision has been made in the case of a "Leaky Condo" project in Delta, BC. The judge found the developer, general contractor, building design company and municipality guilty. The municipality's share of blame was only 20% but all the defendants were jointly liable for the envelope repair costs. Since the municipality has the deepest pockets, it will likely have to pay most of the $3.2 million damages allocated to the 85 owners in the Riverwest project. The decision is being appealed by the municipality.

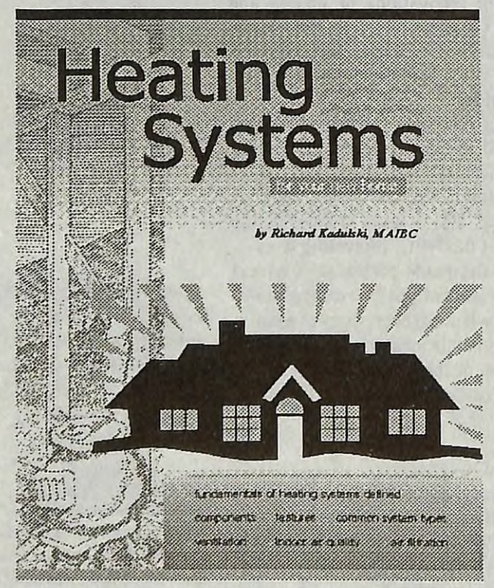
The project, built in 1991, consisted of three wood frame buildings with balconies and face sealed stucco cladding. The flat roofs had no overhangs. The walls continued up past the roof line to form parapets which were protected by metal cap flashings. The plans used for construction did not have details showing how key waterproofing requirements were to be met. The municipality did inspections during construction but these did not cover the building envelope.

The municipality did not require that the drawings presented for building permit be sealed by an architect as a condition of issuance of the building permit. The original design was prepared by an architect, but the working drawings were prepared by an engineering/design company without benefit of an architect during their preparation or review (which can be considered a contravention of the Architect's Act in BC). However, the original architect's name was placed on the permit plans without his knowledge or approval.

No field reviews were done by either an architect or the engineering/design company. Nor did Delta require that any professional provide any indication that the project complied with code requirements. The BC Building Code contains approved text of "letters of assurance" for professionals to use to indicate that the work complies with code requirements.

The judge noted that water leaks and rot in a face-sealed wall were foreseeable in the Lower BC Mainland climate and a history of envelope failures should not have been needed to convince Delta to enforce the relevant sections of the Building Code.

Had all the parties involved followed existing rules and regulations there could still have been problems. However, had all parties done their tasks within their normal scope of work, the amount of any deficiencies may have been less costly and much easier to repair. ☼



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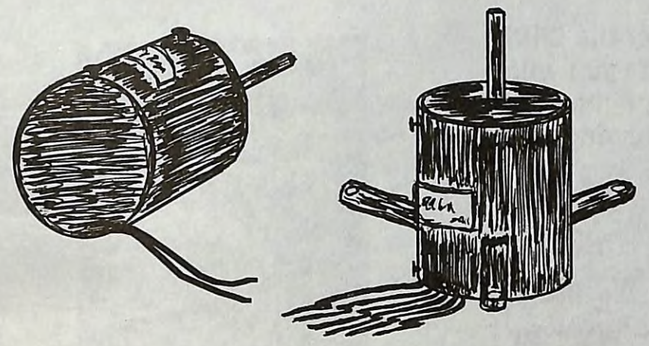

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www.ashrae.org

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Fax: 905-954-0732

March 6-8, 2002
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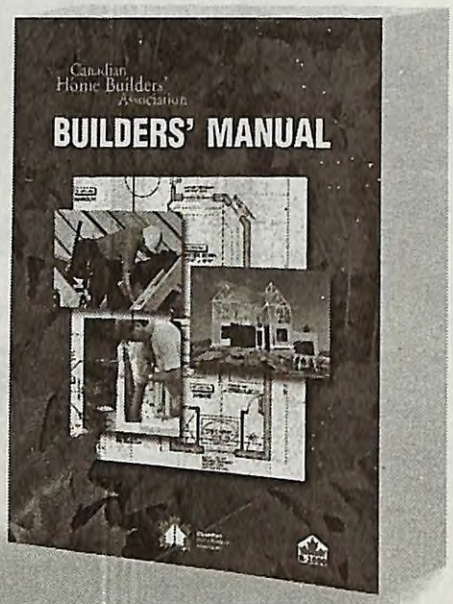

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